TAB J
PART 12

accordance with the present invention;

Figure 3 is a plan view of the card of Figure 2 having its top sheet 4 removed to reveal the printed circuit;

Figure 4 is a cross-section through the card along the line I - I of Figure 3; and

Figures 5 to 13 illustrate various stages in the production of the plastic card depicted in Figures 2 to 4.

Referring first to Figure 2 there is shown a perspective view of the final card which has the same external dimensions as a standard "plastic card". The card contains an integrated circuit. On Figure 2 it is possible to see edge portions of a substrate of the integrated circuit, exposed at a central part of each edge of the card. The integrated circuit communicates with interrogation units via an inductive link located at appropriate locations. The integrated circuit would normally contain a memory device and could be used for any number of purposes, for example recording banking transactions or recording zones of buildings etc to which entry has been gained by use of the card as an identity card.

Referring to Figure 3 there is illustrated a plan view through a section of the card 10 of Figure 2 in the plane of the card. From this and the cross-section along line I - I illustrated in Figure 4 it can be seen that a printed circuit 11 comprises

epoxy/glass substrate 12 and conductive tracks 13, a substantial portion of which form conductive loop 14. Darkly shaded regions 15 and 16 comprise of a thermoset dielectric material. The purpose of the region 15 is to insulate a silver conductor 17 from the inductive coil 14. The purpose of dielectric layer 16 will be explained later.

An integrated circuit and capacitive components, not shown in Figures 3 or 4, are contained within a capsule-like element 19 which is separated by cut 18 from the rest of the substrate 12. The region 20 of the substrate 12 is lowered below the plane of the printed circuit 11, the integrated circuit and capacitive components being located in potting compound 21 sandwiched between the portion of the substrate 20 and a capping portion 22 of the same material as the substrate 12.

The printed circuit 11 and element 19 are sandwiched between two outer sheets 23 and 24 of PVC thermoplastics material and two intervening layers (not shown in Figures 3 or 4), of polyester which is coated on both sides with a thermally activated catalyst adhesive by which the laminated structure is adhered. This polyester acts as a reinforcing layer preventing element 19 "breaking out" of the PVC layers 23 and 24.

The fabrication process of the card illustrated in Figures 2, 3 and 4 begins with a substrate sheet 12 of copper-clad epoxy/glass which is etched to form a large number of identical printed circuits 13, each as illustrated in Figure 5. On top of each printed circuit is printed a thermoset dielectric material indicated by the shaded regions

15, 16 which is cured in place. The function of circular part 15 is explained below. The linear part 16 serves as an insulator to separate printed conductive link 17 between inner and outer ends of a coil 14 defined by part of the printed circuit 13. Separated from a main part of the substrate by lines of weakness not shown are a number of strips (not shown), each carrying printed patterns 25 (only one of which is illustrated), with apertures 26 therein, which ultimately become the top reinforcing caps of the elements 19.

The substrate carrying the etched patterns is placed on a bed of a screen printing machine (not shown) and a screen placed over it. A squeegee is then used to print a low ionic epoxy encapsulant/adhesive material onto positions 27 as shown in Figure 6. This is a mixture of a resin and a catalyst which sets hard when cured. Suitable materials are, for example, available from Ablestick, Encaremix, or Dexter Hisol. The substrate is then placed in a "pick-and-place" machine which places components comprising of capacitors 28 and silicon chips 29, shown in Figure 7, onto the epoxy which acts as an adhesive to hold them in place. The silicon chips 29 at this stage are "naked", that is to say they are not encapsulated. A notable feature of this process is that the epoxy is applied to areas where there is no copper layer, this being unnecessary because of the adhesive attachment of the components. A saving of 35 microns in thickness is thus achieved as compared with arrangements where components are soldered on top of a copper track. It will be appreciated that this reduction of thickness may be of crucial importance in situations where there may typically be a requirement for the entire assembly not to exceed 760 microns. An

advantage of using epoxy adhesive is that if suitably selected it remains in its adhesive state for a sufficient time period which exceeds the maximum period during which the screen printing machine is not being operated. This avoids the need to clean down the equipment.

The sheet substrate carrying the etched patterns and respective components positioned on it, is then baked until the epoxy has gelled, i.e. set but not hardened. This takes place under a flow of nitrogen to prevent oxidation of the copper. The sheet is then placed on the work-holder of a wire bonding machine where it is held in position by a vacuum. Suitable machines for this purpose are commercially available. Wire connections are then made between contacts on the individual components to appropriate parts of the printed copper circuitry. This is done by an ultrasonically assisted diffusion welding process. The sheet is then placed back in the screen printer with a different stencil in place. This stencil is much thicker, its thickness being selected so that the same epoxy encapsulant/adhesive now to be deposited over the components is sufficient to cover them completely. Notably, this material is the same as that which was used for the adhesive. It does not have to be the same but it preferably has similar physical characteristics. After the removal of the stencil, the sheet is as shown in Figure 8, the components being encapsulated by the encapsulant 30.

Figure 9 shows in cross-section the next stage of the process where a copper spacer 31 having a plurality of apertures 32 (corresponding to each of the regions on

the sheet having encapsulant 30 deposited thereon) is located on the sheet, 12. Previously placed on the copper sheet is each of the now separated strips 33, previously referred to, to form regions defined by printed patterns 25, from which regions reinforcing caps 22 will be formed. The spacer 31, with strips 33 located on it by means of pins (not shown for clarity), has been placed on top of the substrate. The whole arrangement is then pressed such that the patterns 25 are pressed into contact with the spacer 31 which is thus pressed closely down onto the circular part 16 of the dielectric material. It also presses the portions of the strip 33 defined by the patterns 25 onto the, still soft, epoxy encapsulant/adhesive thereby pulling the entire assembly down to the desired height. During this process the encapsulant spreads out as shown in detail in Figure 10, but not as far as the edges of the spacer sheet. It is prevented from doing so by its meniscus acting against the inner edges of the copper pattern 25 and dielectric ring 16, which meniscus thereby defines the radius of the encapsulant.

The whole assembly is now placed in an oven and cured at a temperature of 150°C. This fully gels the encapsulant/adhesive both under the components and the encapsulant portion. The assembly is now placed on a rule die which forms cuts 34 which can be seen in Figure 3. These cuts are "horseshoe-shaped" and configured so that their free ends correspond with the slots 26 (see Figure 5) in the strip 33. Note at this stage that the ends of each cut are located on the copper pads 35 of Figure 3. The cutter presses through the structure as illustrated by dotted lines 36 in Figure 10, leaving the element 19 on a limb of the substrate 11, as is best seen from

Figure 3, and leaving the spacer 31 and remaining portions of the strips 33 free to be removed.

It will be noted from Figure 3 that the electrical connections to the element run parallel to an edge of the card, in which direction the card is most resistant to bending, as opposed to across the hinge line which runs across the corner of the card where it is most susceptible to bending.

Using another rule die, cruciform shapes are cut out of the assembly to give each printed circuit the shape illustrated in Figure 3. This removes the epoxy/glass substrate from those areas which are to become the corners of the finished cards. It is notably these corner parts which are most subject to the type of manipulation which encourages de-lamination.

The printed circuit 11 with reinforced element 19 is now placed, as shown in Figure 12, between two outer sheets 37 and 38 of thermo plastics material in the pvc family with the inter-position of polyester layers coated on both sides with a thermally activated catalyst adhesive 21. As shown in Figure 12 sets of assembled layers 42 are placed between pressing plate 42 which are placed in pressing case 43. This comprises a lid portion which seals against sealing insert 44 but is free to be compressed into the base portion of the case 43. The case has an outlet pipe 45. Note that in Figure 12 although only two sets of layers are in each case, a case could contain many such sets.

Referring to Figure 13 there is illustrated a press in which two cases 43 are positioned between substantially incompressible heating elements connected by pipes 48 to heater 47. The cases are connected by pipe 49 to vacuum pump 50. Again although only two cases have been shown in the press it will be realised that many such cases could be pressed together.

The press of Figure 13 comprises a base plate 51 from which three support columns 52 extend to a fixed top portion 53. From this top portion 53 is hung by means of springs 59 a top platen 54 such that it rests slightly below stops 55 on support columns 51 on which it slides. A bottom platen 56 which can also slide on columns 52 and which supports the heater units and pressing cases is itself supported by a hydraulic ram 57. Once the pressing cases are positioned in the press the ram is activated and raises the bottom platen 56 until the top platen starts to rise which is detected by micro switch 58. The micro switch then sends a signal to a control means 59 which stops the ram 57. The pressing cases 43 are then evacuated by pump 50 and the heater 47 is energised such that it heats the heating units 46.

It will be realised that at this stage there is very little pressure applied to the cases as top platen 54 is still supported by springs 59. This is important otherwise the components sandwiched between the still hard pvc sheets 37 and 38 would be crushed. However there is enough pressure to establish thermal contact between thermal units 46 and all elements in cases 43 including the pvc sheets 37 and 38 which start to soften with the applied heat. When a temperature of approximately

110°C is reached the pvc is fairly soft and an intermediate pressure is applied by ram 57 and the sandwich starts to collapse. During this process the pressure of the ram is pulsed causing progressive compression. During this stage the capsules 19 imbed themselves in the sheets of thermo-plastic material in such a way as to tend to centralise themselves between opposite faces leaving the plane of the substrate sheet 1 on the central axis as shown in Figure 4. The vacuum ensuring no air is trapped. The work piece now heats up more rapidly because of improved thermal contact and the temperature is raised to about 155°C. Full lamination pressure is now applied, activating the catalyst in the adhesive. Whilst still under pressure the assembly is cooled and brought down to room temperature. The press now opens and the assembly is removed to a cutting machine where the individual cards as illustrated in Figures 2 and 3 are cut out.

CLAIMS

1. A method of manufacturing a laminated card one layer of which comprises a printed circuit having components thereon, the method comprising placing the printed circuit and a sheet of protective thermoplastic material together in a press, evacuating and heating the sheet and the printed circuit, and pressing the printed circuit and sheet together such that components on the printed circuit become embedded in the sheet of protective material.

2. A method as claimed in claim 1 wherein the printed circuit is sandwiched between two sheets of protective material.

3. A method as claimed in claim 1 or 2 wherein a number of printed circuits are formed on a common substrate and wherein a sheet of protective material extends over several circuits, the cards being cut from the resultant laminated structure after pressing.

4. A method as claimed in any preceding claim wherein between the printed circuit and sheet of protective material there is placed an intervening layer.

5. A method as claimed in claim 4 wherein the intervening layer is coated with an adhesive which bonds the protective layer to the printed circuit.

6. A method as claimed in claim 5 wherein the adhesive on the intervening layer is a thermally activated catalyst adhesive.

7. A method as claimed in any preceding claim wherein the pressing process comprises: closing a press until the sheet of thermoplastic protective material is in thermal contact with a heating unit; and applying a greater pressure once the thermoplastic material has softened.

8. A method as claimed in claim 7 wherein the press closes until a resiliently mounted reaction platen of the press is displaced, and wherein once the thermoplastic material has softened the said greater pressure forces the reaction platen into contact with mechanical stops.

9. A method as claimed in claim 7 or 8 wherein after a period at the greater pressure the pressure and temperature are further increased.

10. A method as claimed in claim 9 wherein the further increase in temperature causes the adhesive to cure.

11. A method as claimed in any preceding claim wherein the pressure applied by the press is pulsed.

12. A method as claimed in any preceding claim wherein the resultant laminated

structure is cooled whilst still under pressure.

13. A method as claimed in any preceding claim wherein the sheet of protective material and printed circuit are placed together between a base portion and cover portion of a pressing case which are arranged to slide relative to each other on the action of the press, the pressing case comprising an airtight seal between the portions and an outlet by which the pressing case can be evacuated.

14. A method as claimed in claim 13 wherein a plurality of sets of printed circuits and protective sheets are contained within a single pressing case, each set being separated by a rigid plate.

15. A method as claimed in claim 13 or 14 wherein a number of pressing cases are assembled between the platens of a press.

16. A method as claimed in claim 15 wherein a substantially incompressible heating unit is placed between each adjacent pair of pressing cases in the press.

17. A method substantially as hereinbefore described with reference to Figures 12 and 13 of the accompanying drawings.

18. A press substantially as hereinbefore described with reference to, and as illustrated in, Figure 13 of the accompanying drawings.

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Examiner's report to the Comptroller under Section 17 (The Search Report) 16

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GB 9313747.9

Relevant Technical fields

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G J W RUSSELL

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

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Documents considered relevant following a search in respect of claims 1-18

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2225283 A (DE LA RUE) - see page 11 lines 3-29	

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

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(56) Documents Cited
GB 2267682 A US 4450024 A

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UK CL (Edition N) B5N , B6A AK
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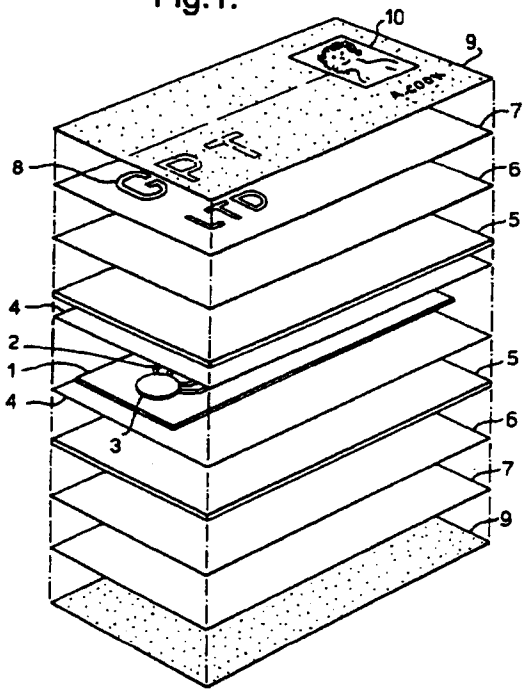
(54) Manufacturing a smartcard

(57) A smartcard is manufactured by providing a substrate (1), carrying electronic components (2), and which is dimensionally stable at the laminating temperature. A layer of thermoplastic material (5) dimensionally unstable at the laminating temperature is provided on either side of the substrate (1). A further layer of plastics material, e.g. polyester (8) which is dimensionally stable at the laminating temperature is provided on the outerface of each thermoplastic layer. At least one of these layers (7) is provided with an image (8). A further clear layer (9) is provided on the outside of the card and is formed from a material, such as PVC, which is capable of accepting a dye diffusion image (10). Finally the layers are heated and compressed to bond them together.

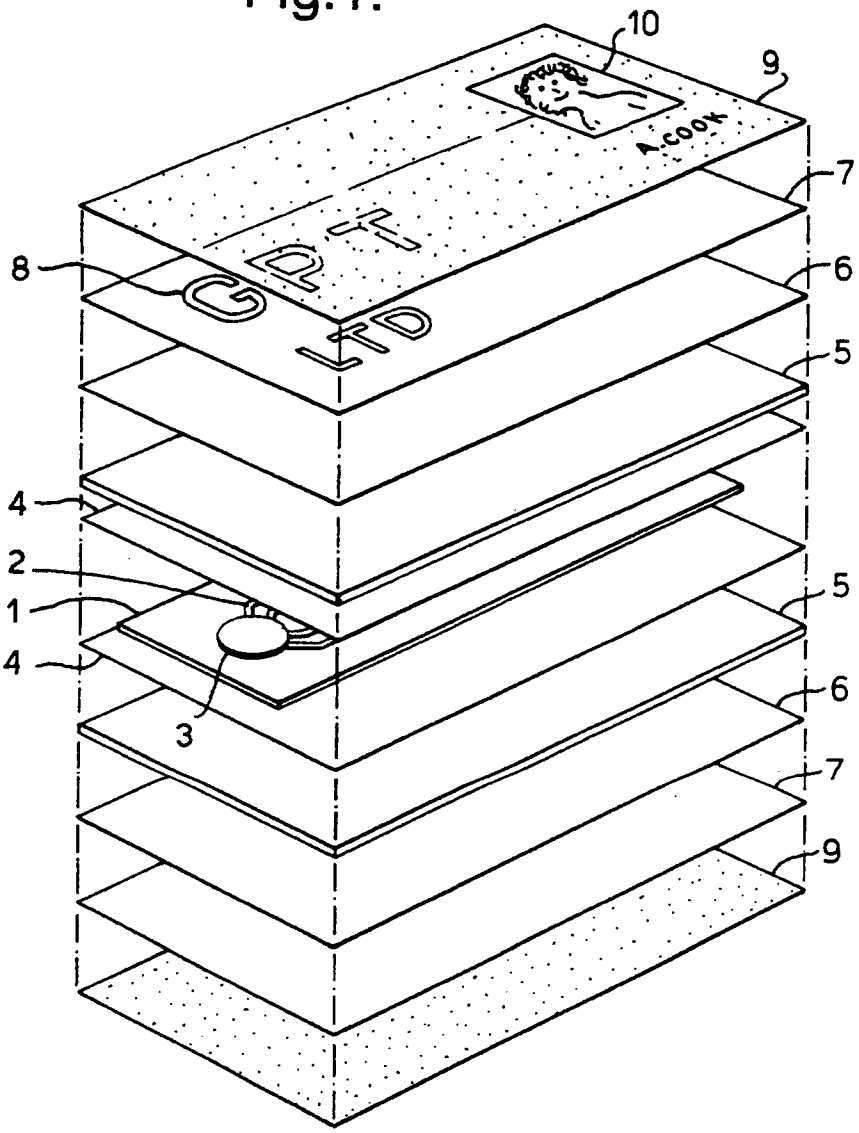
Fig.1.



GB 2 294 899 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1.



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METHOD OF MANUFACTURING A SMARTCARD

This invention relates to a method of manufacturing a smartcard, or a card typically of credit card size dimensions which contains electronic components for data storage and processing, although the term as used herein is intended to encompass cards which, for example, contain only a memory and in which no actual data processing is performed.

There is frequently a requirement for a smartcard to support textual or graphic material and the need to incorporate electronic components within the card sometimes means that the outermost surface is uneven thereby leading to distortion in any printed image. There is also often a need for a card issuing authority to print customised data in addition to that already provided in the card, for example a photograph of an employee for a security card application. It is an aim of the present invention to provide a method of manufacturing such a card which can overcome both of these problems.

In a first aspect this invention provides a method of manufacturing a laminated smartcard by heating a plurality of layers to bond them together, comprising the steps of; providing a substrate, carrying electronic components, which is dimensionally stable at the laminating temperature; providing a layer of thermoplastic material dimensionally unstable at the laminating temperature on either side of the substrate; providing a layer of plastics material which is dimensionally stable at the laminating temperature and which has relatively high tensile strength on the outerface of each thermoplastic layer, at least one of these layers being pre-printed with an image; providing a further clear layer on the outside of the card formed from a material capable of accepting a dye diffusion image; and heating and compressing the layers to bond them together.

It has previously been proposed to encapsulate the electronic components within a smartcard with a thermoplastically deformable material, such as PVC. Such material can provide good support for the electronic components but tends to leave an uneven surface surrounding the components which is not suitable for printing. Any printed image placed directly on the thermoplastic layer prior to heating would tend to distort when hot. The applicants have appreciated that a layer formed from a dimensionally stable high tensible material, such as polyester, will not tend to follow the movement of the thermoplastic material as it deforms around the components during lamination so that distortion of the pre-printed image is avoided. Being pre-printed, as opposed to printing directly onto the encapsulating thermoplastic layer means that should a printing error occur then only that layer need be scrapped as opposed to a complete finished card. The high tensile layers on each side of the thermoplastic layer also increase the rigidity of the card. The clear outermost layer can provide a glossy appearance to the card and also permits a card issuing authority to print an image on top of a previously formed card by a dye diffusion technique, also known as video dumping, by which a card users photograph or other customised data may be printed. Preferably the clear layer is a thermoplastic material such as PVC which can be provided with a matt finish during the heat and compression step to reduce specular reflections.

The invention also provides a heat laminated smartcard comprising a substrate carrying electronic components, a layer of thermoplastically deformable material on either side encapsulating the substrate, a layer of plastics material which is dimensionally stable at the laminating temperature and which is of relatively high tensile strength on the outerface of each thermoplastic layer, at least one of these layers bearing an image, and a further clear layer on the outside of the card of a material capable of accepting a dye diffusion image.

In order that the invention may be better understood an embodiment thereof will now be described by way of example with reference to the accompanying figure which shows a perspective exploded view of a smartcard.

Referring to Figure 1 a contactless laminated smartcard comprises a substrate 1 formed from a dimensionally stable material, such as a polyester, carrying an inductive coil and associated electronic tracks 2 together with electronic components, indicated at 3 and previously "glob-topped" in known fashion with an acrylic based resin. On either side of that is provided a polyester sheet 4 which carries on each face an acrylic based adhesive incorporating a thermally activated catalyst. Such adhesives are available and have the advantage that heating to a predetermined temperature causes the catalyst to be activated and the components of the adhesive to bond rapidly. Above that there is provided a layer of thermoplastic material 5 such as PVC and a further layer of adhesive 6 of generally similar type to that in the layer 4. A layer of polyester 7, or other relatively thermally dimensionally stable material 7 is provided above the adhesive layer 6 and carries graphic material 8. On the outside surfaces of the card a layer of thermoplastically deformable material 9 is provided, such as PVC, which can receive a dye diffusion image 10 after manufacture of the card, as will be described later on.

The polyester layers will not soften or become dimensionally unstable until a temperature of about 250°C, while PVC softens and becomes fluid at about 140-150°C.

During manufacture the layers are placed between two halves of a mould (not shown) and heated to a temperature of about 150°C. The PVC layers 5 soften and flow around the components 3 on the substrate 1. The applied heat activates the catalyst in the adhesive layers

4 and 6 bonding the substrate 1 to the PVC layer 5 and the PVC layer 5 to the polyester layer 7. The polyester layer 7 being relatively more dimensionally stable and having a high tensile strength at the laminating temperature does not tend to follow the movement of the thermoplastic material and thus distortion of the image 8 is prevented. The moulding plates are adapted to provide the PVC layers 9 with a matt or slightly textured finish so as to reduce specular reflection from the finished card.

The PVC layer 9 is also suitable for accepting an image 10 using a so called video dumping technique (not shown). A thermal printhead is heated and as it passes over the card surface dyes sublimate from the printhead and diffuse into the PVC layer 9.

The card shown in Figure 1 is for a security card application in which a card, without the image 10, would be sold to a user for them to print an image, e.g., of an employee together with other customised data.

The PVC layer 9 provides a glossy finish and feel to the card and also protects the underlying graphics 8. Such an arrangement has the advantage that it would be very difficult to remove the image 10 and reprint with fraudulent data without removing the layer 9 which would tend to destroy the graphics 8. In this way the claimed arrangement can aid in providing evidence that a card has been tampered with.

Although as described the dimensionally stable layer is a polyester it is conceivable that other materials could be used instead. Similarly, the PVC layer 9 may be replaced by a pretextured material which is relatively more dimensionally stable, for example a polyester.

CLAIMS

1. A method of manufacturing a laminated smartcard by heating a plurality of layers to bond them together, comprising the steps of; providing a substrate, carrying electronic components, and which is dimensionally stable at the laminating temperature; providing a layer of thermoplastic material dimensionally unstable at the laminating temperature on either side of the substrate; providing a layer of plastics material which is dimensionally stable at the laminating temperature and which has relatively high tensile strength on the outerface of each thermoplastic layer, at least one of these layers being pre-printed with an image; providing a further clear layer on the outside of the card formed from a material capable of accepting a dye diffusion image; and heating and compressing the layers to bond them together.

2. A method according to claim 1 in which the dimensionally stable layer is a polyester.

3. A method according to claim 1 or 2 in which the clear layer is a thermoplastic material dimensionally unstable at the laminating temperature and in which the outermost surface is provided with a textured finish during the heating and compression step.

4. A method according to claim 3 in which the clear layer is PVC.

5. A method according to any preceding claim in which the thermoplastic layer adjacent the substrate is PVC.

6. A method according to any preceding claim in which the heating step is carried out at

about 150°C.

7. A method according to any preceding claim in which the adhesive used to bond together one or more of the layers is an acrylic based adhesive incorporating a catalyst activated during the heating step.

8. A method according to any preceding claim in which an image is formed on the clear layer using a dye diffusion process.

9. A heat laminated smartcard comprising a substrate carrying electronic components, a layer of plastics material which is dimensionally stable at the laminating temperature and which is of relatively high tensile strength on the outer face of each thermoplastic layer, at least one of these layers bearing an image, and a further clear layer on the outside of the card of a material capable of accepting a dye diffusion image.

10. A method of manufacturing a smartcard substantially as described with reference to the drawings.

11. A smartcard substantially as described with reference to the drawings.

7

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9422793.1

Relevant Technical Fields

(i) UK Cl (Ed.N) B5N, B6A (AK)

(ii) Int Cl (Ed.6) B32B, G06K

Search Examiner
R J MIRAMS

Date of completion of Search
6 FEBRUARY 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE: WPI, CLAIMS

Documents considered relevant following a search in respect of Claims :-
1 to 11

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2267682 A	(GEC AVERY)	
X	US 4450024 A	(HAGHIRI-TEHRANI) eg Figures 5 and 5a	at least 1, 2,5 and 9

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

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(43)公開日　平成６年(1994)６月24日

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Ｂ４２Ｄ　15/10	５２１	9111－2C			
Ｇ０６Ｋ　19/077					
		8623－5L	Ｇ０６Ｋ　19／00	Ｈ	
		8623－5L		Ｋ	

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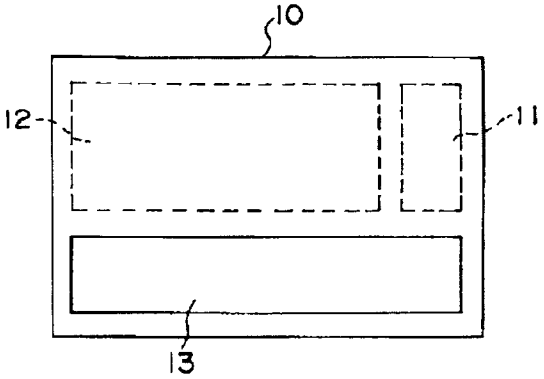
(54)【発明の名称】　薄型非接触ＩＣカード

(57)【要約】

【目的】　ＩＣモジュールと、ＩＣモジュールに接続され外部装置と非接触で信号の受発信を行う受発信用コイルを内蔵した非接触ＩＣカードであって、厚みを薄くして薄型のカード状とすることにより、携帯性を向上させると共に、曲げ、衝撃に対する強度を向上させた薄型非接触ＩＣカードカードを提供する。

【構成】　薄型ＩＣモジュールおよび薄型受発信用コイルを重ね合わせることなく平面配置すると共に、薄型ＩＣモジュールおよび薄型受発信用コイルの両面にプラスチック製フィルムを介在させ、さらに両面からプラスチック製表面材で挟持して、加熱圧着して固着一体化した薄型非接触ＩＣカード。

【効果】　厚みを薄くして薄型のカード状とすることにより、携帯性を向上させると共に、曲げ、衝撃に対し強度を向上させ、薄型ＩＣモジュールおよび薄型受発信用コイルを外部から確実に遮蔽して、外部から水が侵入して薄型ＩＣモジュールおよび薄型受発信用コイルが破損するのを防止することができる。



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【特許請求の範囲】

【請求項1】薄型ＩＣモジュールと、該薄型ＩＣモジュールに接続され外部装置と非接触で信号の受発信を行う薄型受発信用コイルを内蔵した薄型非接触ＩＣカードであって、前記薄型ＩＣモジュールおよび薄型受発信用コイルを重ね合わせることなく平面配置すると共に、薄型ＩＣモジュールおよび薄型受発信用コイルの両面にプラスチック製フィルムを介在させ、さらに両面からプラスチック製表面材で挟持して、加熱圧着して固着一体化したことを特徴とする非接触ＩＣカード。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、ＩＣモジュールと、ＩＣモジュールに接続され外部装置と非接触で信号の受発信を行う受発信用コイルを内蔵した非接触ＩＣカードに関し、とくに厚みを薄くして薄型のカード状とすることにより、携帯性を向上させると共に、曲げ、衝撃に対する強度を向上させた薄型非接触ＩＣカードに関する。

【０００２】

【従来の技術】従来、ＩＣモジュールと該ＩＣモジュールに接続され外部装置と非接触で信号の受発信を行う受発信用コイルを内蔵した非接触ＩＣカードとしては、図４に斜視図で示すように、ＩＣモジュールＸと受発信用コイルＹとを、プラスチック製の箱体Ｚ１と蓋体Ｚ２とからなる匡体Ｚ内に収納し、箱体Ｚ１と蓋体Ｚ２とを接着したもの、あるいはＩＣモジュールＸと受発信用コイルＹとを金型内に配置し、プラスチックを射出成形して一体化するものが知られている。

【０００３】

【発明が解決しようとする課題】上記従来の非接触ＩＣカードでは、プラスチック製の箱体Ｚ１と蓋体Ｚ２とからなる匡体Ｚ内に収納し、箱体Ｚ１と蓋体Ｚ２とを接着するものにおいては、箱体Ｚ１と蓋体Ｚ２との接着が十分でないと、接着箇所から水が内部に侵入し、ＩＣモジュールＸと受発信用コイルＹが破損するおそれがあり、また、厚みも約１０mmと厚いものであった。また、ＩＣモジュールＸと受発信用コイルＹとを金型内に配置し、プラスチックを射出成形して一体化するものにあっては、金型内にＩＣモジュールＸと受発信用コイルＹとを配置するのに手間がかかるばかりか、射出成形により、平板状で、厚みが薄いものを成形すると、反りが生じ、外観上好ましいものが得られない等の問題点があった。

【０００４】

【課題を解決するための手段】本発明は、上記課題を解決するものであって、その要旨は、薄型ＩＣモジュールと、該薄型ＩＣモジュールに接続され外部装置と非接触で信号の受発信を行う薄型受発信用コイルを内蔵した薄型非接触ＩＣカードであって、前記薄型ＩＣモジュールおよび薄型受発信用コイルを重ね合わせることなく平面

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配置すると共に、薄型ＩＣモジュールおよび薄型受発信用コイルの両面にプラスチック製フィルムを介在させ、さらに両面からプラスチック製表面材で挟持して、加熱圧着して固着一体化することにより、厚みを薄くして薄型のカード状とすることにより、携帯性を向上させると共に、曲げ、衝撃に対し強度を向上させ、薄型ＩＣモジュールおよび薄型受発信用コイルを外部から確実に遮蔽して、外部から水が侵入して薄型ＩＣモジュールおよび薄型受発信用コイルが破損するのを防止した薄型非接触ＩＣカードである。

【０００５】

【実施例】以下、本発明の実施例を図面に基づき具体的に説明する。図１は本発明の薄型非接触ＩＣカードを示す平面図、図２は本発明の薄型非接触ＩＣカードの要部を示す断面図、図３は本発明の薄型非接触ＩＣカードを製造する状態を示す側断面図である。

【０００６】図１に平面図で示すように、薄型非接触ＩＣカード１０の外径寸法は、横寸法が約８６mm、縦寸法が約５４mmであり、厚みは約１mmである。薄型非接触ＩＣカード１０には、ＩＣメモリ（図示略）と整流回路等（図示略）を内蔵した薄型ＩＣモジュール１１と、該薄型ＩＣモジュール１１に接続された薄型受発信用コイル１２を内蔵している。１３はエンボス領域であって、薄型ＩＣモジュール１１が内蔵された位置と薄型受発信用コイル１２が内蔵された位置を避けて形成してある。このように、エンボス領域１３を、薄型ＩＣモジュール１１が内蔵された位置と薄型受発信用コイル１２が内蔵された位置を避けて形成すると、エンボス領域１３にエンボス加工をしても、薄型ＩＣモジュール１１および薄型受発信用コイル１２に影響が少ないので、好適である。図２に断面図で示すように、薄型ＩＣモジュール１１の厚みＴ１は、約０．３mmとしてある。薄型受発信用コイル１２は、厚さＴ２が約０．４mmの平板状フェライトコア１２ａに、直径が約０．１mmの銅線１２ｂを巻き付け、その厚さＴ３は約０．５mmとしてある。薄型受発信用コイル１２は、外部装置と電磁結合または電磁誘導により、薄型ＩＣモジュール１１に記憶される情報を外部装置と非接触で受発信する。薄型ＩＣモジュール１１に設けられた整流回路により、薄型受発信用コイル１２に励起された交流電流を整流して薄型ＩＣモジュール１１の電源とされる。このため、電池を別途内蔵する必要はない。

【０００７】１４、１４は厚みが約０．１mmのポリ塩化ビニル樹脂製等のプラスチック製フィルムであって、薄型ＩＣモジュール１１および薄型受発信用コイル１２の両面から、これら薄型ＩＣモジュール１１および薄型受発信用コイル１２を狭持するようにして介在させてあると共に、厚みが約０．３mmのポリ塩化ビニル樹脂製等のプラスチック製フィルム１４、１４の両面からポリ塩化ビニル樹脂製等のプラスチック製表面材１５、１５

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で挟持して、加熱圧着して固着一体化し、厚みが約1mmとしてある。

【0008】本発明の薄型非接触ＩＣカード10を製造するには、図3に側断面図で示すように、薄型ＩＣモジュール11と薄型受発信用コイル12とが重ね合わないようにして配置し、薄型ＩＣモジュール11および薄型受発信用コイル12の両面に厚みが約0．1mmのポリ塩化ビニル樹脂製等のプラスチック製フィルム14、14を介在させ、さらに両面から厚みが約0．3mmのポリ塩化ビニル樹脂製等のプラスチック製表面材15、15で挟持した後、両面から熱板20、20で加熱圧着して固着一体化すれば良い。

【0009】

【発明の効果】以上の通り、本発明によれば、薄型ＩＣモジュールおよび薄型受発信用コイルを重ね合わせることなく平面配置すると共に、薄型ＩＣモジュールおよび薄型受発信用コイルの両面にプラスチック製フィルムを介在させ、さらに両面からプラスチック製表面材で挟持して、加熱圧着して固着一体化することにより、厚みを薄くして薄型のカード状とすることにより、携帯性を向

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上させると共に、曲げ、衝撃に対し強度を向上させ、薄型ＩＣモジュールおよび薄型受発信用コイルを外部から確実に遮蔽して、外部から水が侵入して薄型ＩＣモジュールおよび薄型受発信用コイルが破損するのを防止することができるなどの利点がある。

【図面の簡単な説明】

【図1】本発明の薄型非接触ＩＣカードを示す平面図

【図2】本発明の薄型非接触ＩＣカードの要部を示す断面図

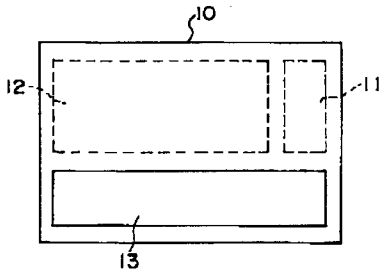
【図3】本発明の薄型非接触ＩＣカードを製造する状態を示す側断面図

【図4】従来の非接触ＩＣカードを示す斜視図

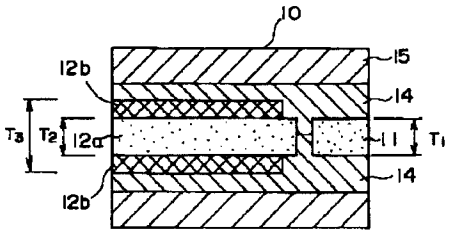
【符号の説明】

10	薄型非接触ＩＣカード
11	薄型ＩＣモジュール
12	薄型受発信用コイル
13	エンボス領域
14	プラスチック製フィルム
15	プラスチック製表面材

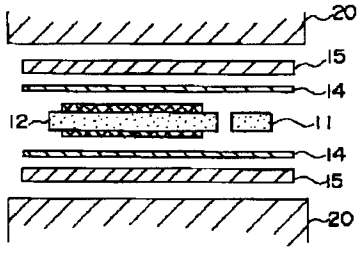
【図1】



【図2】



【図3】



【図4】